

# **It Takes Two to Tango: Argentine Tango Practice as an Intervention for Cancer Survivors**

Honors Research Distinction Thesis

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## **I. PERSONAL RESEARCH STATEMENT**

My research objective is to lay the foundation for my journey as a dancer into a career in medicine. I deeply value the importance of innovative care in medicine to promote discovery and enhance patient experience and health. My involvement in the OSU Department of Dance has equipped me with a skill set related to teaching, performing, improvising and analyzing movement. In addition, I have worked in Professor Worthen-Chaudhari's motion analysis and recovery lab, where I have gained the ability to implement multidimensional approaches to movement rehabilitation. At present, I am committed and enthusiastic about the prospects of dance-based interventions in cancer rehabilitation. My current project aligns with my personal value of helping individuals find healing physically, mentally and emotionally. I believe that what will be most significant about my research is that it will allow cancer survivors to experience medical care that is creatively engaging and personally meaningful.

This project is a culmination of my studies as a dance major on a pre-medicine track at The Ohio State University. In the first part of my undergraduate career I was introduced to Professor Lise Worthen-Chaudhari, faculty in the Department of Physical Medicine and Rehabilitation and OSU Dance alumna. I have volunteered and researched with Professor Worthen-Chaudhari since 2013. This involved working directly with patients and facilitating dance-based interventions during their standard therapy sessions. These patients have been of varying diagnoses (e.g. Parkinson's Disease, Multiple Sclerosis, Cancer Survivors, Individuals post-stroke or traumatic brain injury) and working with these individuals has allowed me to witness the impact of innovative care in medicine. In addition to this experience, my contract curriculum as a

dance major has focused on dance pedagogy and refining my teaching philosophy and teaching methods.

These experiences lead me to design Argentine Tango for cancer survivors in the fall of 2014 when I chose to apply for the Pelotonia Undergraduate Research Fellowship. I was awarded the Fellowship in June 2015 and group dance classes started July 2015 through March 2016, in which I taught Argentine Tango and investigated the impact of a 10-week intervention for cancer survivors.

## **II. PEDAGOGICAL REFLECTION**

In preparation for Argentine Tango for Cancer Survivors as a 10-week group dance class intervention starting July 2015, I designed an independent study to workshop my pedagogy and find my own voice teaching adapted Tango as presented in Hackney et. al research with Parkinson's Disease.<sup>1</sup> I provided private dance education and balance training to a cancer survivor with Chemotherapy Induced Peripheral Neuropathy and an individual with Parkinson's Disease. This opportunity allowed me to generate a warm up that includes balance challenges, weight shifts, and range of motion required for Tango practice. Additionally, I developed a method to break down Argentine Tango technique into principles regarding musicality, social-dance partnering, proper alignment, non-verbal communication, and various embellishment steps to continue to challenge balance and artistry (See XI. Appendix). To present these elements of the dance form it was necessary to develop a language to describe dance principles to individuals new to dance, I found that successful communication of movement principles stems from the use of a combination of learning techniques for

different types of learners (i.e. visual, auditory, reading, kinesthetic). Finally, I was able to craft methods for utilizing quality of movement principles as provided by LMA effort qualities within Argentine Tango practice to transform pedestrian walking to Tango walking.

In July 2015, when the class size shifted from one student to a group class anywhere from five to twenty people, I was presented with new challenges. This is when I discovered the distinct difference between teaching a group of children or my peers and teaching a group of adults, especially teaching a group of adults who all had their lives turned upside down from cancer. These individuals were of different ages, although the majority of our dancers were fifty years old and up. Each and everyone of them brought forth unique experiences and had a different motivation for being present in our Argentine Tango class every Tuesday and Thursday for 10-weeks. Some came to dance because they love to move, some came because they wanted to learn something new, some came to do something with their loved one or caregiver, some came to demystify Argentine Tango, and some came because they were dragged along. My mission at class number one and every class thereafter was to get all of these people, with different stories, motivations and goals, hooked on dance through learning Argentine Tango.

To address these different learning styles and motivations, each class provided a variety of movement objectives to make sure each and every person was engaged. For those that desired structure, Tango class followed a similar format every class and I always shared an overview of the lesson plan at the beginning of class, as well as providing information about what we would be learning in the following class.

Additionally, every class started with a movement generation activity that incorporated principles of community building. This was a place where I could introduce LMA effort qualities relevant to Argentine Tango and dancers could practice understanding and embodying these qualities. This was then followed by a warm up done every class to provide a centering movement exercise to ensure everyone was ready physically and mentally for dance class. This warm up exercise provided consistency and challenge, as it was a place to also introduce new footwork patterns and balance challenges before we learned them in partnered dance. Following warm up we would explore dancing together and principles regarding musicality, partnering and other elements of tango technique. Throughout the 10-weeks I would do a review of these principles to provide repetition, as repetition was the most commonly mentioned piece of feedback about what worked well for class participants in our outcome measure of satisfaction with intervention reported every class. While repetition is invaluable, it was important to always learn new material as a way to keep everyone engaged especially given that our class contained people of all ages and levels.

The most commonly reported challenge in the class was learning new steps, which is the part of class that would come after the review of tango technique. We would learn and review our “step of the day/week” that introduced a new embellishment step (see XI. Appendix, 10-week outline and Step-Guide). Balancing repetition with new material within a one-hour class is challenging but essential for learning and providing a sense of accomplishment, which is extremely valuable in this population. Class ended with repetition and consistency in the form of a final improvised tango dance with focus on continuous flow of dancing and non-verbal communication. Additionally every class

was completed with the same concluding activity that involved upbeat music, celebratory dancing, and bows in acknowledgement of each person's accomplishment and contribution to the class community.

As both dance educator and researcher there were two modes of thinking that I had to balance, increasing movement dose (time of active movement per class) and providing opportunity for Argentine Tango artistry each class. Our goal for using Argentine Tango as a balance intervention was to provide at least 40 minutes of movement dose in a one-hour class. That being said my tendency as a learner and educator is to want to have a thorough explanation physically and musically in order to begin to tap into the artistry of the movement. I was encouraged by Professor Lise-Worthen Chaudhari to balance explicit learning with implicit learning and in these moments I found that the dancers, even though most of them are new to the dance form, have incredibly smart "thinking" bodies. For example, after a class session spent explicitly learning the backwards ocho step via a thorough breakdown and explanation, I challenged the class to quickly observe the forward ocho step and then apply their implicit learning to allow their bodies to figure out the step in the reverse direction. I was surprised that the dancers needed less verbal instruction than I anticipated and with this information I chose to utilize explicit and implicit learning within each class session.

Another way that balance of movement dose and artistry was present in my pedagogy was in the need to standardize each class for the sake of research, yet allow for the artistry needed to properly dance the Tango. In order to tap into performance qualities and artistry that are essential in dance practice, I introduced these aspects of artistry actively so as to not deviate from the movement dose. For example, if I was

guiding the class towards a more performative intention, I would first set them up in an active task such as practicing the “Tango Sway” that occurs at the beginning of every dance to connect with your partner. When learning a new step, this blend of dosage and artistry would also come into play in that dancers wanted explanation, so we would practice moving together and breaking down the steps actively. This way movement dose and artistry found balance and blended so that the act of dancing was never separate from the art of dancing.

What set this experience apart from other dance classes I have taught or participated in was the instantaneous community that formed in all three 10-week sessions. Each community was unique but all held the same principles of support, positivity and enthusiasm, potentially bonded by cancer. Coming together as individuals who have survived or who are surviving cancer, with both their cancer experience and dance as a unifier contributed to shaping our class community. Additionally, I believe the nature of Argentine Tango practice cultivates community as it is a social-partnered dance, a new form and language for all participants, and a dance with emphasis on community (i.e. moving in a circle, navigating the space, the element of touch and connection). This strong class community provided a safe space for self-expression and exploration through dance, which in turn allowed each participant to have a greater movement dose. Dance as an intervention promotes greater engagement in one's treatment, it allows individuals to personalize their recovery through the self-expression and artistic freedom that dance and dance alone provides.



*The remainder of this document is written from the perspective of the Research Team that includes Marie Lamantia and Professor Lise Worthen-Chaudhari.*

### **III. ABSTRACT**

Cancer survivors have reported that problems in balance and walking are a leading cause of distress and discomfort post-cancer. This critical loss of balance function is attributed to deconditioning and peripheral neuropathy resulting from chemotherapy treatments or lymphedema. Our study evaluates feasibility of the use of Argentine Tango to improve balance among cancer survivors, focusing on survivors who are deconditioned or nerve damaged (e.g. Chemotherapy Induced Peripheral Neuropathy). Our primary aim is to determine the feasibility of conducting a 10-week, dance-based balance intervention given concerns regarding retention and compliance among participants who are receiving concurrent care in oncology and rehabilitation. Our follow-on aim is to establish pilot data regarding the impact of participation on balance function, specifically on balance measures that have been shown to correlate to participant risk of falling (i.e., root mean square medial-lateral sway amplitude during eyes closed condition). We offered 20 sessions (1-hour each) of Argentine Tango over 10 weeks and collected the following data each class: attendance, satisfaction with intervention. In addition, at three time points (baseline, 5 weeks, 10 weeks) we collected a biomechanical measure of fall risk. Satisfaction with intervention was high for cancers survivors and controls. In addition we report balance data from a group of cancer survivors with peripheral neuropathy post cancer due to chemotherapy or lymphedema and age-matched controls. At the beginning of the intervention this group of cancer

survivors started at higher than normal medial-lateral sway indicating high fall risk, but ended within normal range by midpoint (5-weeks) of the intervention. The cancer survivors showed an average 56% reduction in medial-lateral sway at midpoint ( $p < 0.01$ ) achieving values comparable to controls. This work provides the first known evidence regarding whether cancer survivors find a dance-based intervention, Argentine Tango, satisfying and feasible for balance improvement. Improved control of lateral stability after 5-weeks of practice indicates that Argentine Tango is a promising balance intervention for cancer survivors experiencing impaired balance post treatment.

#### **IV. INTRODUCTION**

Cancer and its treatments can adversely impact the body's systems and functions, especially those involved in preventing falls. Cancer survivors report that dysfunction in balance and walking causes distress and discomfort post-cancer, in addition to being the leading functional deficit among survivors.<sup>2</sup> Moreover, balance deficits increase the risk of falls,<sup>2</sup> which is the leading cause of injury and death for older adults including individuals with cancer,<sup>3</sup> resulting in serious comorbidities for cancer survivors. Loss of balance function among cancer survivors has been attributed to deconditioning post cancer treatment and peripheral neuropathy following chemotherapy (Chemotherapy Induced Peripheral Neuropathy, CIPN) or lymphedema.

The incidence of CIPN post cancer, and associated gait and balance deficits, is rising.<sup>3</sup> The condition has been associated with, "Decreased quality of life, reduced functional ability, and increased risk of falls." It has also increased utilization of health-care and increased cost of health care.<sup>5</sup> There is a lack of supporting research about

treatment options for CIPN, including limited knowledge of the impact of exercise interventions for CIPN to address balance impairment and other functional losses.<sup>5</sup>

Group dance classes have been found to improve markers of quality of life and physical health (i.e., balance) among some populations engaged in rehabilitation, such as the elderly<sup>5,6</sup> and individuals with Parkinson Disease.<sup>8-13</sup> However, such interventions have yet to be studied among cancer survivors despite the relevance of quality of life and physical health within cancer survivorship.<sup>2,14-16</sup> Group dance classes are a promising avenue in that they deliver an activity-based intervention in a social context, potentially improving physical as well as psychosocial aspects of health. In particular, the dance style of Argentine Tango has been shown promising in other rehabilitation populations such as previously mentioned groups, perhaps because this style incorporates varied, dynamic qualities of movement in basic walking patterns within a potentially motivating, social setting. Additionally, it includes improvisational movement elements that provide balance challenges in non-clinical environments. The purpose of this project is to address the current gap in knowledge by piloting the Argentine Tango style of dance as a balance intervention among cancer survivors. If Argentine Tango is found to be efficacious as a balance treatment for cancer survivors, it would represent a novel, social, engaging option to reduce fall risk in this population.

## **V. METHODS**

### **V1. Subjects**

This protocol was approved by The Ohio State University Institutional Review Board. Cancer survivors over the age of 18, with or without CIPN were eligible for this

study. Twenty cancer survivors (age=62.9±9.7, 18F/2M) consented to participate and 9 support givers (age=69.3±10.0, 3F/6M, of whom 4 were non-neurologically impaired). We refer to support givers as partners through this document.

## **V2. Intervention**

The Argentine Tango 10-week intervention was taught by investigator Marie Lamantia and was offered twice a week for one hour in the JamesCare for *Life* Activity Center (Suite 2100) in The James' Stefanie Spielman Comprehensive Breast Center. There were a total of three 10-week sessions, Summer (July 7- September 10, 2015), Fall (October 1- December 10, 2015) and Winter (January 12- March 17, 2016). These classes were open to all cancer survivors and family members; even those not directly involved in this study, to encourage community outreach and increase patient participation.

Lessons included quality of movement instruction, lower body balance warm up, tango-style walking, musicality lessons, footwork patterns, partnered dancing, weight shifts, movement generation exercises, and social dance improvisation. Class structure followed the adapted Tango model proposed by Hackney<sup>1</sup> for individuals with Parkinson's Disease. More detail about class structure is available in Table 1.

Argentine Tango technique allows participants to practice control of movement as the dance consists of different speeds, step size, and shifts of weight. It has been reported that,

“Tango may be especially helpful compared with other dances because of the specific movements it incorporates, such as backwards walking. Tango offers

physical and cognitive challenges, as it incorporates low-level aerobic activity and movements that challenge gait and balance while also requiring high-level multitasking and progressive motor skill learning in the presence of external cues provided by the music and the partner.”<sup>13</sup>

Additionally, the basal ganglia, the part of the brain responsible for movement coordination, may be activated during rhythmic, metered movement such as seen in Argentine Tango practice and inherent in the music.<sup>8</sup>

**V3. Table 1: 1-Hour Cancer Survivor-Specific Argentine Tango Class Structure**

Lesson Plan	Time	Music	Activities	Objectives
Upper body warm up/Name Game	5 min	None	In a circle each participant generates a movement while saying their name, the rest of the group repeats the name and movement	<ul style="list-style-type: none"> <li>Generating creative movement</li> <li>Teaching tango specific movement qualities (i.e. sharp and sustained time)</li> <li>Cultivating community</li> </ul>
Lower body warm up	5 min	“Champagne Tango”	Tango-specific plie, tendu, ronde de jambe sequence to warm up muscles, balance, breathing and proper alignment	<ul style="list-style-type: none"> <li>Challenge/warm up use of weight, range of motion and balance in lower limbs</li> <li>Practice proper alignment for tango technique</li> </ul>
Partnering enhancement exercise	2 min	“La Capilla Blanca”	“Tango Sway” (change of weight) in partners, pouring weight from foot to foot, followers close eyes	<ul style="list-style-type: none"> <li>Awareness of switching axis of body</li> <li>Shifting weight and full spine from side to side to free up foot to step forward</li> </ul>
Music/Rhythmic training w/ Partnered walking	8 min	“El Choclo” “Organito de la Tarde”	Partnered walking practicing moving on the beat, half-time and “hiccup step” (slow, slow, quick, quick, slow)	<ul style="list-style-type: none"> <li>Leading with the upper body, moving entire center of mass, and keeping heels together</li> <li>Focus on taking larger direct steps together to move in space</li> <li>Practice musicality</li> </ul>
New Step of the Day	20 min	“El Amancer” “A la Gran Muneca”	Introduce step of the day (i.e. “Ocho Step”), break into leader and follower footwork and upper body movement, put step together, and practice with music  Add in embellishments	<ul style="list-style-type: none"> <li>Enhance partnering ability</li> <li>Practice non-verbal communication</li> <li>Introduce new steps that challenge the mind and body</li> <li>Reinforce proper alignment in a new step</li> </ul>
Review of previous steps/Final improvisation	15 min	Assorted Argentine Tango Music	Review steps learned in previous classes  Discuss ways to enhance the step musically and qualitatively	<ul style="list-style-type: none"> <li>Practicing recall skills</li> <li>Enhancing improvisation by providing tools to remember tango steps</li> <li>Challenging musicality and quality of movement</li> </ul>
Concluding activity	5 min	Fun Tango Music	Cool-down walk in circle, celebratory dance, turn into circle for group bow and applause	<ul style="list-style-type: none"> <li>Celebrating within community</li> <li>Creating a sense of accomplishment</li> </ul>

Additionally, the basal ganglia, the part of the brain responsible for movement coordination, may be activated during rhythmic, metered movement such as seen in Argentine Tango practice and inherent in the music.<sup>8</sup>

#### V4. Outcome Measures

Data collected each class included participant attendance and satisfaction with intervention in order to evaluate our primary feasibility aim. Information on concurrent therapeutic activity as well as optional feedback was collected each session, in order to receive self-report feedback from participants and monitor and develop the research and educational methods. The following is a description, followed by a summary, of the outcome measures used.

The Portable Force Plate was used as a quantified balance measure during balance tests to collect medial and lateral postural sway.<sup>17</sup> Balance measures collected on the force plate are more sensitive to the dynamic nature of balance. Control of lateral stability, a measure on the force plate, is reported as one of the best predictors of fall risk when measured during quiet standing with eyes closed (*M-L Sway EC*).<sup>17</sup>

Perception of Physical State is part of the SF-36v2 that is a functional measure of perceived physical function. In a study where fall risk in cancer survivors was examined, participants who reported a low quality of life in the physical health domain of the SF-36v2 were found to have higher risks of falling.<sup>2</sup>

Changes in chemotherapy-induced peripheral neuropathy related symptoms may also be assessed using established patient-reported as well as quantitative measures. The European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30<sup>18</sup> and EORTC CIPN20<sup>19</sup> instruments have been validated for use in cancer patients to assess quality of life and sensorimotor symptoms. Finally, a common symptom in patients with peripheral neuropathy is reduced joint position sense (JPS) in the ankles, which can contribute to functional instability<sup>20</sup>. We collect these additional measures

related to CIPN, in order to determine specific effects resulting from the intervention in this subpopulation of participants.

We also assessed changes in movement quality during dynamic tasks of walking and dancing. We used a portable motion capture system to quantify changes in gait stability in the oncology clinic. Changes in spatiotemporal gait parameters have been shown to predict fall risk in the elderly<sup>22</sup>.

Additionally, one qualitative dance-based measure that has been shown to represent the physical correlates underlying movement dynamics<sup>23</sup> is Laban Movement Analysis (LMA), a vocabulary and framework for categorizing dynamic movement qualities, but that has not been adopted as an outcome measure within rehabilitation research as of yet. In order to document the movement dynamics promoted by the intervention, we will analyze movement using LMA. Additionally, quality of movement will be utilized as a pedagogical strategy via LMA principles. Using video recorded during each class, the effort qualities of Weight, Time, Space and Flow will be ranked with a five point Likert scale by individuals trained in Laban Movement Analysis within the OSU Department of Dance.<sup>23</sup>

*Summary of primary and secondary outcome measures:*

Primary Outcome Measures:

- Attendance
- Participant satisfaction with the intervention

Additional information collected:

- Cancer diagnosis and treatment
- Attendance with/without partner
- Concurrent rehabilitation and oncology care
- Rehabilitation and oncology care in the two months prior to enrollment. This data was collected because treatment experience immediately prior to enrollment may impact attendance and baseline performance data.
- Incidence of falls or near falls since last report.

- Reasons why eligible volunteers refuse (e.g., challenges with regard to transportation or scheduling).

Additionally, to investigate the impact of participation on physical health and quality of life, we collected data at 3 time points: (baseline, 5 weeks, 10 weeks). This data included the following outcome measures:

Secondary Outcome Measures:

- Quantified measures via portable force plate: Amplitude of medial-lateral sway while participants stood with eyes closed<sup>16</sup> (*M-L sway EC*) on an instrumented platform (Bertec Corp, portable force platform, 1000hz).
- SF-36v2<sup>2</sup>
- EORTC QLQ-C30<sup>18</sup>
- EORTC CIPN20<sup>19</sup>
- Ankle JPS<sup>20</sup>
- Berg Balance Scale<sup>21</sup>
- Quantitative gait stability measures via portable motion capture system: average and variability measures of spatiotemporal gait parameters (e.g., stride length, stride time, step width)<sup>22</sup>
- Laban Movement Analysis qualitative effort measures<sup>23</sup>

## V5. Analysis

Mean satisfaction with intervention scores are reported for cancer survivors and partners separately. Participants' risk of falls at baseline, as indicated by Berg Balance Scale or *M-L sway EC*, was evaluated. Those survivors who demonstrated increased risk of falls on Berg ( $< 45$ ) or *M-L sway EC* ( $> 2$  standard deviations outside healthy control norm) were analyzed for change in balance at 5 weeks in comparison to age-matched healthy controls. A paired sample t-test was used to analyze the balance data. Satisfaction with intervention is reported but not statistically analyzed, as appropriate for the feasibility design of primary outcome measure analysis, which involved no comparison to a non-intervention group.



## VI. RESULTS

Argentine Tango for cancer survivors was shown to be a safe intervention with no adverse events, trips, or dropouts, validating its feasibility as an intervention. Additionally, satisfaction with intervention was high for cancer survivors (average=1.4, on a 1-7 scale, with 1=very satisfied, n=20) and partners (average=1.8, n=9). Although no participant was identified as being at higher risk of falls based on Berg Balance Scale scores at baseline (cancer survivors mean =  $55.5 \pm 1.2$  out of 56; partners mean =  $54.2 \pm 2.5$  out of 56), a subset of cancer survivors (n= 4, age= $67.8 \pm 13.7$ , 3F/ 1M) was determined to have balance deficits based on *M-L sway EC* values at baseline. When compared to age-matched healthy controls (n=4, age= $70.3 \pm 9.8$ , 2F/2M) this subset showed 56% improvement in *M-L sway EC* at 5 weeks (see Figure 1) ( $p < 0.01$ ; mean pre:  $8.4 \pm 1.1$ mm, mean post:  $4.7 \pm 0.5$ mm, n=4) achieving values comparable to controls by the 5 week mark (mean pre:  $4.5 \pm 1.6$ mm, mean post:  $3.5 \pm 0.5$ mm, n=4).

### VI1. Figure 1: Change in Control of Lateral Stability

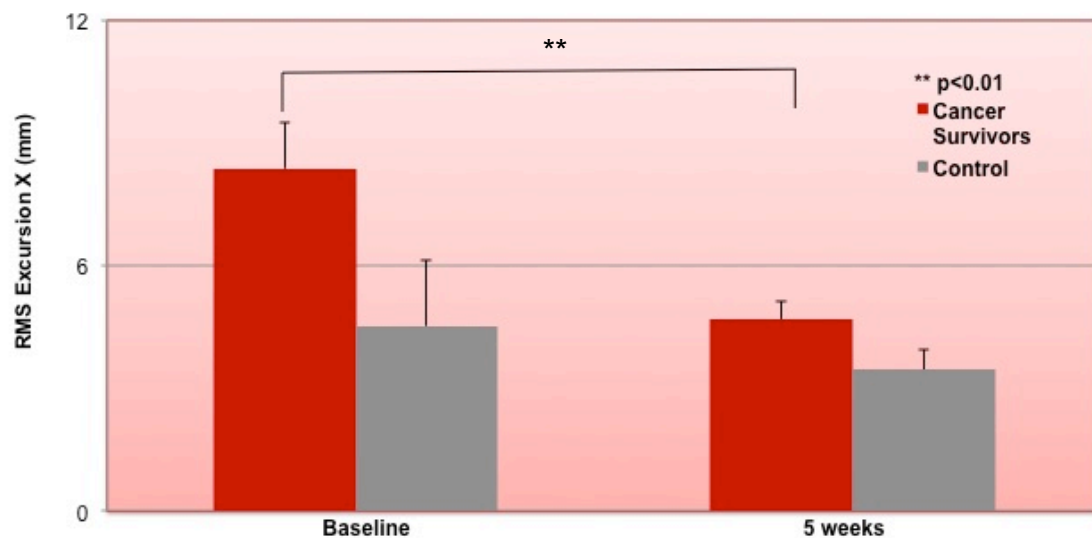


Figure 1: *M-L sway EC* of cancer survivors/controls, indicating an increase in cancer survivors' control of lateral stability from baseline to midpoint (5-weeks) in the intervention. \*\*  $p < 0.01$

As the Tango educator, investigator Marie Lamantia reports, “I have personally witnessed the immeasurable joy, confidence and enhanced quality of movement in each Argentine Tango dancer over the course of 10-weeks.” Analysis of additional outcome measures (CIPN20, QLQ-C30, SF-36v2, Ankle JPS, Gait Stability and LMA effort qualities) is currently in progress to further investigate the impact of this intervention among cancer survivors.

## **VII. DISCUSSION**

This project advances cancer research in several ways, in addition to giving back to the cancer survivor community. Firstly, this work provides the first known evidence regarding whether cancer survivors find a dance-based intervention, Argentine Tango, satisfying and feasible for balance improvement. Secondly, improved control of lateral stability after 5-weeks of practice indicates that Argentine Tango is a promising balance intervention for cancer survivors experiencing impaired balance post treatment. Additionally, Laban Movement Analysis (LMA) used as a pedagogical and movement analysis tool in this study is significant because quality of movement is yet to be measured in balance rehabilitation research, yet movement quality is what allows individuals to negotiate different environments and situations in everyday life.

One challenge we faced was detecting change in balance function in this population of cancer survivors. Although balance issues are a main cause of lost quality of life post treatment, the balance deficits seen in this population are more subtle than those seen in other populations (e.g., spinal cord injury, Parkinson Disease). Many of the clinical outcome measures have a ceiling effect, meaning that they detect severe balance deficits but not mild or moderate, such as cancer survivors face. While we

collected a clinical outcome measure (Berg), we also collected a more sensitive measure of balance, that requires more high-tech equipment, but has been found to predict fall risk in a host of neural conditions (*M-L Sway EC*).<sup>17,24</sup> We found that detecting balance deficits in our cohort was not possible using the Berg Balance Scale due to the ceiling effect. Among our cancer survivor population we found that control of lateral stability as measured by *M-L Sway EC* was the most sensitive measure for balance deficits experienced due to CIPN.

Finally this project gives back to the cancer survivor community by providing a celebratory performance event, as the promise of a performance is relevant to the mastery of dance. In addition to the element of social support present within the 10-week intervention, prolonged community building was evidenced by continued involvement beyond the end of the study. Eighteen of 29 participants participated in a performance at The Ohio State University, as well as 3 rehearsal sessions to choreograph and practice. An additional 3 participants attended the performance as spectators. Pelotonia staff has reached out to the investigating team asking how they can help to continue this line of research. Ultimately, cancer survivors experienced a dance-based intervention that is creatively engaging and personally meaningful. Argentine Tango for cancer survivors contributes to lifelong health and sustainability by providing an intervention that improves physical health in a social setting and offers an artistic outlet via dance.

## VIII. FUTURE GOALS

In the near future we will be evaluating the lasting impact of Argentine Tango as

an intervention by collecting retention data 3 weeks post intervention. Additionally, in April and May 2016 we will provide a performance experience for participants to allow them to celebrate their story with their family and friends, as well as reaching out to the community to promote the arts and cancer research. Research into dance-based interventions is critical and promising, however, there is a potential disconnect between the standardization needed to create a reproducible dance class and the celebration of mastery of the skills taught. We seek to unify the experience of dance as an intervention and dance as a celebration for the participants in our 10-week long prospective studies. Due to the research needs classes must be standardized to a certain extent and participants commit to twenty hours of dancing and data collection in ten weeks. We seek to give back to the participants and their caregivers by providing a celebratory performance event. Cancer Survivors in the Columbus community that did not get to participate in the Tango classes will also be encouraged to attend, as well as members of the OSU medical and dance communities, to promote cancer research and the integration of the arts and medicine.

We also plan to secure funding for a larger trial so that we can gather more subjects to strengthen our findings and provide an innovating and engaging intervention for more individuals with balance deficits post-cancer. Ultimately, we aim to promote use of the arts, specifically dance, as a way to provide innovative and personalized care to treat the whole person and an important area of research.

## **IX. ACKNOWLEDGEMENTS**

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## **XI. APPENDIX**

### **XI1. Argentine Tango Intervention 10-Week Outline**

**Week 1:** Introduction to Tango (Forward, Back, Side Steps), Data Collection 1

**Week 2:** Musicality introduction, Rock Step, Cruzada Intro

**Week 3:** Open embrace partnering, Rotating Rock Step, Sandwich Step

**Week 4:** Spirals of spine, Follower Embellishments, Cruzada Step

**Week 5:** Traveling in space, Leg Wrap Step, Data Collection 2

**Week 6:** Standing leg stability, Leg Wrap Step, Cruzada exit

**Week 7:** Working leg power, Ocho Prep, Back Ocho Step

**Week 8:** Improvisational choices, Front Ocho Step, 180 Step

**Week 9:** Musical improvisation inspiration, Side-by-Side Walking, Windmill Step

**Week 10:** Artistry in Argentine Tango, Review of Steps, Data Collection 3

## ARGENTINE TANGO GUIDE

BY: MARIE LAMANTIA

ATango Step	How does it start?	Leader Part	Follower Part	Notes
<b>Hiccup Step</b>	Forward walking	Slow, Slow, Quick, Quick, Slow (Use upper body to send energy of each step)	Same as leader	This is the tango rhythm, for quick step on faster tempo (not half-time) take smaller steps.
<b>Side Steps</b> <b>A. Sideways Sway</b> <b>B. 2-Steps One Way</b>	Side steps	Leader can lead A. Step to the side in a sway B. Take 2-steps one way	Same as leader	To take two steps one way you must change your partners weight (like the Tango sway at the beginning of a dance), to free up that same foot to take another step in the same direction
<b>Rock Step</b>	Left forward step	Take a step with your inside foot (L foot) and catch your partner with your back hand before they collect, and rock your weight back and forth as you remain in a wide forward step.  <i>To exit: Shift the weight forward onto the left foot and collect.</i>	Same as leader	The rock step always begins on the left foot of the leaders  Keep hips in line, pointing straight forward
<b>Rotating Rock Step</b>	Left forward Step	Leaders get into rock step. As you are rocking, leaders can gradually rotate in a counterclockwise circle	Same as leader	Make sure to do a complete 360, so you are facing the right way. Don't just stop at 180.
<b>Sandwich Step</b>	Side step (L foot steps side and R foot sandwiches)	The sandwich step starts with a step to the side. Rock your weight into the circle (L) and take a step outside the circle (R) and collect to prepare. Take a step into the circle (L) and then leaders sneak your right foot in between your partner's feet before they collect to make the sandwich. Leaders then lead the foot out and followers bring the foot back in. <i>To exit: See Notes section</i>	Take side steps with leader until you notice their foot is sandwiched, they then lead out and the FOLLOWER brings the foot back in  Embellishments: Take time to do foot taps, circle of the leg (rond de jambe), leg flicks, leg drag up the leaders leg, etc.	<i>To exit: When you want to get out of the step, leaders all of your weight should be on your left foot (back foot) so you can take a small step forward right foot, sending your follower back.</i>

ATango Step Cruzada Step	How does it start?	Leader Part	Follower Part	Notes
	Forward steps (L foot forward to cruzada)	<p>1. Leader rock your weight into the circle, take a step with the outside foot (R foot) and collect to prepare.</p> <p>2. Then take a step with your inside foot (L). As you collect twist your inside arm/spine <b>back</b> to cruzada your partner.</p> <p>3. Then untwist, and change your weight (to the R foot), to take a step forward with your inside foot (left foot) again.</p>	Followers, when your partner twists your spine/arm forward, it should spiral your body into cruzada, which is where your left foot crosses over your right. Then you take a step back with your right foot to get out of the crossed cruzada position	<p>Leader:</p> <p>Step R</p> <p>Step L (twist on collect)</p> <p>Change weight (to R)</p> <p>Step L (to get out)</p> <p>Follower:</p> <p>Step L</p> <p>Step R</p> <p>Cruzada L foot in front</p> <p>Step R</p>
Leg Wrap Step	From Side step (Sandwich Step)	<p>Starts from the sandwich step. (See above)</p> <p>Lead your partner's foot out, then plant your R foot, so your followers can't lead you back in.</p> <p>Then pull your arm back, rotating your spine, which sends your partner's leg back, then twist your body forward, causing your partner's leg to wrap around your planted leg.</p> <p><i>To exit: collect your planted leg while twisting partner back, and then switch your weight to your right (outside) foot while bringing your partner's leg forward to cruzada, then take a step with your left foot.</i></p>	<p>Comes from a sandwich step (see above).</p> <p>Your partner will lead your leg out, then plant their foot so you can't lead their leg back in. Then your leader will twist your body, moving your R arm/spine forward and sending your leg back. When your leader twists you the other way, it will move your arm backwards and send your leg into the leg wrap around their planted leg.</p> <p><i>To exit: Your partner will collect their planted leg, meaning you have nowhere to wrap your leg around. This sends you into the cruzada, so you cross your left foot over your right, then take a step back with your right foot.</i></p>	<p>If you're falling over, move your planted foot more towards the middle of your partners, to have a more solid foundation</p> <p>Also if you can leave your foot on the ground if you are losing balance</p> <p>Follower Tip: Make sure you're relaxed so your leg can easily swing back and forth.</p>

ATango Step	How does it start?	Leader Part	Follower Part	Notes
<b>Back Ocho</b>	From a side step (L foot)	<p>1. Leaders rock your weight into the center of the circle (to your left) then take a step with your right foot, and collect as a preparation</p> <p>2. Take a step into the circle (L), 3. Secretly <b>switch your weight</b> to your right foot and twist your body, moving your arms/spine <b>back</b>, Then take another step to your left.</p> <p>4. As you collect twist your body, moving your arm/spine forward. Then take a step outside with the R foot.</p> <p>To exit: Slow down, and as you collect after taking a step, only twist your body halfway, stopping your partner. Then <b>switch your weight</b> and take a step forward.</p>	<p>When your partner twists your body, pivot on your right foot, and take a step back with your left foot. As they twist you the opposite way, pivot on your left foot and take a step back with your right foot.</p> <p>You get out of the step when your leader only twists halfway, stopping you in the middle of the ocho. Then you take a step back.</p>	<p><b>Leader tips:</b> Take your time, when you change your weight to take another side step to start back ocho, make sure your partner is still on their right (inside foot)</p> <p>As you twist your body make sure your partner's hip move to be in a position perpendicular to your own.</p> <p>Step side R Step side L (Change weight to R) Twist arm/spine <b>back (for back ocho)</b> Step side L (as you collect twist forward) Step side R</p> <p><b>To get into ocho you must change your weight and to get out of ocho you must change your weight</b></p> <p><b>Follower tips:</b> Practice follower step against a wall if needed</p> <p>Find a bend in the knees to ground yourself as you pivot on one foot</p>
<b>Front Ocho</b>	From a side step (L foot)	The front ocho is almost the same as the back ocho, except the <b>leader twists their arm forward</b> , which makes the followers take a step forward instead of a step back.	Instead of a step back the followers pivot on R foot bringing the left foot forward to take a step on the forward L, then pivoting on the Left to bring the right foot forward and stepping on the right forward	<p><b>Leader tip:</b> If partner is moving too close to you in the forward ochos angle your side steps slightly backwards</p> <p>If in BACK ochos your partner is moving too far away from you angle your side steps slightly forward to stay connected</p>

ATango Step 180 Step	How does it start? From a forward step (Left)	Leader Part	Follower Part	Notes
		<p>1. Leaders take a step with your left foot, but catch your partner before they step (like the rock step)</p> <p>2. Bring your partners weight forward by sending your weight slightly back</p> <p>3. Send your partner forward by moving your R arm forward and sending your follower around you on your right.</p> <p>4. Then pivot 180 degrees towards your back foot (R), and collect your back foot (L)</p> <p>Then do the same thing again on the L foot, so you'll be facing the right way.</p>	<p>Followers, when your leader catches you, all your weight should be on your right (back) foot. As they send you forward your weight is then on your front (left) foot</p> <p>Take two quick steps to the left of them (Right, Left). And then as they turn, you pivot on your Left foot and collect your back foot.</p> <p>Then repeat the step so, you are facing the right way.</p>	<p>This step plays with momentum, lead will send their partner around them first by leading with their upper bodies and then their pivot of the legs will follow closely.</p> <p>Leaders are the base of this step, make sure your stance is strong and not too wide</p> <p>Leaders use your arm on your partner back to send them stepping forward <b>For L, pivot the left.</b></p>
<b>Side-by-Side Walking</b>	From 180 Step, forward step (Left)	<p>See above for how to get into 180 step</p> <p>Instead of pivoting your legs once you lead your follower to step R, L, pivot on the left, you collect your front foot (L) backwards to meet up with your partner so that your bodies are facing the same way (Counter-clockwise). You should have your weight on your R foot and your partner will have their weight on their left foot so that you can walk together "outside foot, inside foot, outside foot" and so on.</p>	<p>See above for 180 step</p> <p>You will step R, L and pivot on the left foot to then be facing CCW to walk with your partner side-by-side. You should have all your weight in your left leg so that you will start with your outside foot (R).</p>	<p><i>To exit: Leader will pivot follower back around (typically easiest when follower is on L foot and leader is on right foot, begin normal Argentine Tango walking)</i></p>

ATango Step	How does it start?	Leader Part	Follower Part	Notes
<b>Windmill Step</b>	From a side step	<p>Take a side step out of the circle on the (R foot) to prepare</p> <p>“Pizza Step” Leader opens the Left foot to make a triangle space in between the feet, keeping the heels attached, as they do this they open with their upper body to the Left (sending follower into a side step around them).</p> <p>Then leader “closes the pizza” with the R foot and the upper body closes by twisting the follower to step back (lead backwards) or forward (lead forward)</p> <p><i>To exit: Cruzada step, When closing with R foot, send your partners foot to cruzada by crossing their bodies forward and then take a step forward on the Left</i></p>	Grapevine step: R foot opens Side, L foot closes back/forward, R foot opens side, L foot closes back/forward	In this step the leaders is the pivot po and the follower pivots around them in circle, make sure you make a full 360 order to keep traveling in the line of dance (counter clockwise)
<b>KEY TANGO TIPS:</b>				
<b>A. Tango Sway:</b>	<p>Heels together toes, slightly apart.</p> <p>Both lead and follower have weight slightly forward in the balls of the feet.</p>	<p>Leader leads tango sway (like a metronome) switching the axis of the body from one foot to the other, pouring the weight from one foot to the other.</p> <p>This frees up one foot to step</p>	Follower allows leader to guide their movements. Keeping the body like a plank and not bending at the hips.	
<b>B. Tango Embrace</b>	<b>1. Leaders</b> make eye contact with the person you want to dance with and offer them your left hand (inside circle hand).	<b>2. Followers</b> complete the embrace and put your left hand on the leader's shoulder.	<b>3. Leaders</b> put your right hand on the follower's scapula	Make sure to maintain an Argentine Tango “A” in the inside arm hands that are holding, don't allow one person to push or pull too much. It should be a comfortable relaxed position.